The documentation process conversion measures necessary to comply with this revision shall be completed by 25 September 1997

INCH POUND

MIL-PRF-19500/627A
25 June 1997
SUPERSEDING
MIL-S-19500/627
18 November 1994

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER,
ULTRAFAST, TYPES 1N6688, 1N6689, 1N6688US, AND 1N6689US,
JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, hyper fast power rectifier diodes. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figures 1 and 2.

1.3 Maximum ratings.

Types	V_{RWM}	I_O 1/	t_{rr}	I_{FSM}	$R_{\theta JL}$	$R_{\theta JE}$	T_{STG} and T_J
		T_A = +25°C		t_p = 8.3 ms, T_A = +25°C	at L = 0.35	2/	
	V dc	A dc	ns	A (pk)	°C/W	°C/W	°C
1N6688,1N6688US	300	20	40	375	4	3.5	-65 to +175
1N6689,1N6689US	400	20	40	375	4	3.5	-65 to +175

1/ Derate linearly at 267 mA/°C from +100°C to +175°C.
2/ -US suffix devices only.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5961

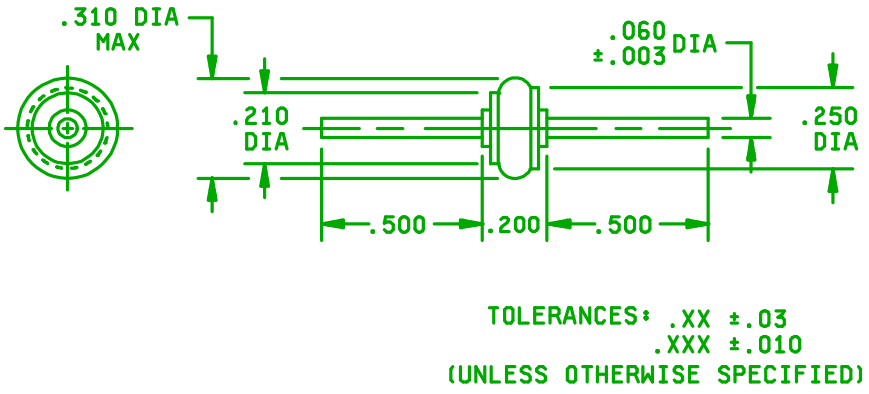

FIGURE 1. Dimensions and configuration for 1N6688 and 1N6689.

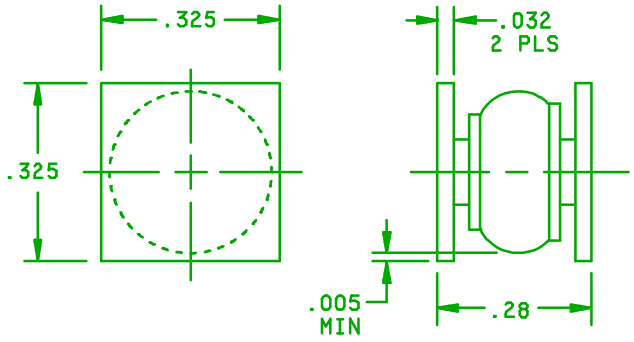

FIGURE 2. Physical dimensions for surface mount devices (1N6688US and 1N6689US).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated detail specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified on figures 1 and 2 herein. The US government's preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

3.3.1 Diode construction. These devices shall be constructed utilizing non-cavity double plug construction with metallurgical bonding between both sides of the silicon die and terminal pins (see MIL-PRF-19500). Metallurgical bond shall be in accordance with the requirements of category 1 in MIL-PRF-19500. -US version devices shall be structurally identical to the non-surface mount devices except for lead terminations.

3.3.2 Lead formation and finish. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish or formation is desired, it shall be specified in the acquisition document (see 6.2).

3.3.3 Polarity. Polarity shall be marked with a contrasting band or dot on the cathode side of the diode body.

3.4 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.4.1 Marking for the -US devices. For -US devices only, all marking may be omitted from the device except for the cathode marking. All marking which is omitted from the body of the device shall appear on the label of the initial container.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with appendix E, table IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see appendix E, table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c 1/	Thermal impedance (see 4.3.2)	Thermal impedance (see 4.3.2)
9	Not applicable	Not applicable
10	Not applicable	Not applicable
11	V_{F1} and I_{R1}	V_{F1} and I_{R1}
12	MIL-STD-750, method 1038; test condition A; t = 240 hours; V_R = 80 percent of rated V_R; T_A = +125°C	MIL-STD-750, method 1038; test condition A; t = 48 hours; V_R = 80 percent of rated V_R; T_A = +125°C
13	Subgroup 2 of table I herein; V_{F1} and I_{R1}; ΔV_{F1} = ± 100 mV (pk); ΔI_{R1} = ± 5 µA dc or 100 percent from the initial value, whichever is greater.	Subgroup 2 of table I herein; V_{F1} and I_{R1}; ΔV_{F1} = ± 100 mV (pk); ΔI_{R1} = ± 5 µA dc or 100 percent from the initial value, whichever is greater.

1/ Thermal impedance shall be performed any time after screen 3.

4.3.1 Burn-in conditions. Burn-in conditions are as follows: T_A = +125°C; V_R = 0.8 to 0.85 rated V_R dc (see 1.3).

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500 and table I herein. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection:

a. I_M measure current - - - - - - - - - - - - - - 10 mA.

b. I_H forward heating current - - - - - - - - - - 5 - 50 A.

c. t_M heating time - - - - - - - - - - - - - - - - 50 ms.

d. t_{MS} measurement delay time - - - - - - - - - - 100 µs minimum.

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}$(max) = 3.8°C/W. For -US devices, $Z_{\theta JX}$(max) = 3.3°C/W.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VIa (JANS) and table VIb (JANTX and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table I, group A, subgroup 2 and 4.4.5 herein.

4.4.2.1 Group B inspection, appendix E, table VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
3	4066	I_{FSM} = rated (see 1.3); 10 surges of 8.3 ms each at 1 minute intervals. Condition B, T_A = +25°C.
4	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or I_O = 2 A minimum for 2,000 cycles.
5	1027	I_O = 2 A minimum, adjust T_A or I_O to achieve an average $T_J \geq$ +250°C.

4.4.2.2 Group B inspection, appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
3	4066	I_{FSM} = rated (see 1.3); 10 surges of 8.3 ms each at 1 minute intervals. Condition B, T_A = +25°C.
4	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or I_O = 2A minimum for 2,000 cycles.
5	3101	Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table I, group A, subgroup 2 and 4.4.5 herein.

4.4.3.1 Group C inspection, appendix E, table VII of MIL-PRF-19500.

Subgroup	Method	Condition
2	2036	Test condition A, weight = 10 pounds, t = 15 seconds.
3		Not applicable.
6	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or I_O = 2 A minimum for 6,000 cycles.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps and footnotes of table I, group A, subgroup 2 herein and 4.4.5.

4.4.4.1 Group E inspection, appendix E, table IX of MIL-PRF-19500.

Subgroup	Method	Condition	Sampling plan
1	1051	500 cycles.	22 devices, c = 0
2	1038	Condition A, t = 1,000 hours V_R = 80 percent V_{rated}	22 devices, c = 0
3		Not applicable	
4	3101	T_A = +25°C; $R_{\theta JL}$ (or $R_{\theta JE}$) = rated $R_{\theta JL}$ (or $R_{\theta JE}$) (see 1.3).	5 devices, c = 0
5	1016	V_R = rated V_R (see 1.3); pressure = 33 mmHg; t = 1 minute (minimum), R_{ISO} = 2.0 x 10^6 Ω maximum.	5 devices, c = 0

4.4.5 Group B, C, and E electrical measurements (delta requirements).

Test	Method	Condition	Symbol	Maximum	Unit
V_F	4011	I_F = 5 A (pk); pulsed (see 4.5.1)	V_{F1}	0.78	V dc
ΔV_F	4011		ΔV_{F1}	± 100	mV dc
I_R	4016	DC method, V_R = rated V_R (see 1.3); pulsed (see 4.5.1)	I_{R1}	50	µA dc
ΔI_R	4016		ΔI_{R1}	± 5 or 100 percent, whichever is greater.	µA dc

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in 4.3.2.1 of MIL-STD-750.

4.5.2 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit (not to exceed the group A, subgroup 2 limit) for $Z_{\theta JX}$ in screening (appendix E, table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X, R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for engineering evaluation and disposition.

4.5.2.1 Thermal impedance ($Z_{\theta JX}$ measurements) for initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101 (read and record date $Z_{\theta JX}$). $Z_{\theta JX}$ shall be supplied on one lot (500 pieces minimum) and a thermal response curve shall be submitted. Twenty two of these samples shall be serialized and provided to the qualifying activity for correlation prior to shipment of parts. Measurements conditions shall be in accordance with 4.4.1.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance	3101	See 4.4.1	$Z_{\theta JX}$			°C/W
		1N6688, 1N6689			3.8	
		1N6688US, 1N6689US			3.3	
Breakdown voltage	4022	I_R = 100 :A dc; pulsed (see 4.5.1)	V_{BR}			V dc
		1N6688, 1N6688US		300		
		1N6689, 1N6689US		400		
Forward voltage	4011	I_F = 5 A (pk); pulsed (see 4.5.1)	V_{F1}		0.90	V dc
		I_F = 20 A (pk); pulsed (see 4.5.1)	V_{F2}		0.97	V dc
		I_F = 70 A (pk); pulsed (see 4.5.1)	V_{F3}		1.2	V dc
Reverse current leakage	4016	DC method; V_R = rated V_R (see 1.3); pulsed (see 4.5.1)	I_{R1}		50	µA dc
Subgroup 3						
High temperature operation:		T_C = +100°C				
Reverse current leakage	4016	DC method; V_R = rated V_R (see 1.3); pulsed (see 4.5.1)	I_{R2}		10	mA dc
Low temperature operation:		T_A = -65°C				
Forward voltage	4011	I_F = 5 A (pk); pulsed (see 4.5.1)	V_{F4}		1.0	V dc
Subgroup 4						
Scope display evaluation	2/					
Reverse recovery time	4031	Condition B; I_F = .5 A, I_R = 1 A; I_{RR} = .25 A	t_{rr}		40	ns
Junction capacitance	4001	V_R = 10 V dc; f = 1 MHz; V_{SIG} = 50 mV (p-p) (maximum)	C_J		400	pF
Subgroups 5, 6, and 7						
Not applicable						

1/ For sampling plan, see MIL-PRF-19500.

2/ The reverse breakdown characteristics shall be viewed on an oscilloscope with display calibration factors of 20 to 50 µA/ division and 20 to 200V/division. Reverse current over the knee shall be at least 100 µA. Each device may exhibit a slightly rounded characteristic and any discontinuity or dynamic instability of the trace shall be cause for rejection.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL- PRF-19500.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No.19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force - 17
NASA - NA

Review activities:
Army - AR, MI, SM
Navy - AS
Air Force - 19, 85, 99

Preparing activity:
DLA - CC

(Project 5961-3469)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-19500/627A	**2. DOCUMENT DATE (YYMMDD)** **970625**

3. DOCUMENT TITLE
SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, ULTRAFAST, TYPES 1N6688, 1N6689, 1N6688US, AND 1N6689US, JANTX, JANTXV, AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Alan Barone	b. TELEPHONE (Include Area Code) (1) Commercial (614)692-0510 (2) AUTOVON 850-0510
c. ADDRESS (Include Zip Code) Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000.	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340